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Borehole Scanner Survey

Prepared by B. B. Thapa

1.0 Purpose

1.1 To assure the accuracy, validity, and applicability of the methods used to collect National digital images of borehole walls, this procedure is a guide for Lawrence Berkeley Laboratory (LBNL) personnel and contractors performing the described activity.

1.2 This procedure describes the components of the work. It also describes the detailed methods to be used for calibration, operation, and performance verification of any equipment, if needed. In addition, it defines the requirements for data acceptance, documentation, and control; and it provides a means of data.

2.0 Scope

2.1 This procedure applies to all LBNL personnel and their contractors who may perform borehole scanning using the Core Borehole Scanner System, or use data obtained from this procedure.

2.2 For all technical activities, data collected from using this procedure and any equipment calibrations or recalibrations that may be required shall be in accordance with this technical procedure. Variations are allowed only if and when this procedure is formally revised, or otherwise modified.

2.3 This procedure is designed to provide detailed methodology to assure consistent conduct of Borehole Scanner Surveys.

3.0 Procedure

The objective of the borehole scanner survey is to obtain unrolled images of the borehole wall by using the Borehole Scanner System (BSS).

3.1 System Components - The BSS consists of a probe, controller unit, winch, winch controller, depth encoder, TV monitor and videocassette recorder. The probe contains a white light source, a magnetic compass, mirrors, a motor, photoelectric sensors and data amplifier circuit boards. The controller unit is used to operate the probe and record the data. The data is recorded on a digital audio tape drive housed inside the controller unit. The winch controller is used to control the rate at which the probe is lowered down the borehole by the winch during the scanning or during retrieval of the probe from the borehole. The TV monitor shows an

unrolled view of the borehole wall as scanning proceeds and the VCR is used to record an analog version of the data.

3.2 Borehole Size - The BSS uses lenses of varying focal range depending on the diameter of the borehole to be scanned. The available lens and focal range in terms of borehole diameter are f2O (60-75mm), f4O(l6O-200mm), f5O(180-250mm) and f6O(250-350mm). The correct size lens for the borehole to be surveyed Is factory set by the manufacturer of the Borehole Scanner - Core Corporation.

3.3 Site Preparation - The BSS requires clear fluid or air in the borehole to operate Successfully. Muddy fluid will result in no image or a very poor image. It the borehole is filled with Muddy fluid, it is necessary to pump out the muddy fluid and let the water in the borehole settle for about 48 hours prior to scanning. It is important to ensure the stability of the borehole prior to inserting the probe. Borehole collapse during scanning can result in loss or serious damage to the probe.

3.4 Calibration Requirements - The BSS must be checked to see if the azimuth gage is performing accurately as described under section 3.6(i). The volume of light used depends on the clarity of any fluid in the borehole and the color of the rock. If the borehole fluid contains suspended solids or If the color of the rock Is very dark a higher volume of light should be used. The volume of light should be adjusted to obtain a realistic color on the TV monitor as much as possible.

3.5 Materials Required.- The following categories of equipment and supplies are needed

(a) Power source - 110V, 60 Hz power through a generator or outlet If available
(b) Tripod capable of supporting 300 lb.
(C) Sieve with a diameter between 6 Inches and a foot
(d) Extension cables and a multiple outlet strip with at least 6 outlets.
(e) Computer data grade Digital Audio Tapes (DAT) of Digital Data Storage (DDS) standard.
(f) VHS tapes of 120-180 minutes -
(g) Working gloves, preferably leather

3.6 Data Collection - The BSS is used as follows

(a)'Place the winch within a few meters of the borehole to be scanned and secure the winch so that the force on the cable will not be able to move it.
(b)Place a tripod over the borehole and position a sieve at the top of the tripod.
(c)Place the winch controller on top of the winch.
(d)Place the controller, TV monitor and VCR within easy access from the location of the winch.
(e) Connect the controller, winch, winch controller, TV monitor and VCR to each other and to the power supply. Note Instruction [abets on system components when n)making these connections.

(f) Use the winch controller to let out a few meters of cable from the Winch and connect the cable to the top end of the BSS probe.
(g) Turn on the power supply to the controller unit and turn on the BSS scanner. Slowly increase the light volume to about one quarter the maximum value. Let the scanner warm up for about 15 minutes.
(h) Hold the probe uptight and test that the BSS is working property. This test may be done by slowly moving an image (the operators hand is convenient) over the scanning window of the probe. An unrolled image of the test image should show up on the TV monitor.
(i) Check that the BSS compass is property aligned and is working. To do this, first use a compass to identify north. Then run a test image with a marker across the scanning window such that the marker is aligned with north as determined by the field compass. The test image should show up on the TV monitor with the marker at the center of the monitor.
(j) Insert a digital audio tape (DAT) and a VHS tape into the DAT drive and the VCR respectively.
(k) Place the cable from the winch to the probe through the sieve and lower the probe into the borehole. Slack in the cable may be eliminated by either rolling In the winch or manually lowering the probe into the borehole a short distance.
(l) Place the depth encoder on top of the borehole and pass the cable through the encoder wheels.
(m) Initialize the screen of the TV monitor to show the north direction in the center of the screen and the scanning depth using the controller unit.
(n) Begin lowering the probe into the borehole at a steady rate less than 40 cm/sec. Continue until the end of casing is seen on the TV monitor. Note the depth at which the end of casing was observed.
(o) Roll in the winch so that the probe is brought to a depth less than the end of casing depth.
(p) Lower the probe once again - this time reset the depth counter to the known depth to end of casing when the end of casing is seen. If the end of casing cannot be used as a reference for the depth into the borehole for some reason, the depth should be initialized with respect to some other feature such as the top of the borehole.
(q) Bring the scanner back up about one meter above the end of casing and lower It at a steady rate. Turn on the DAT recorder and the VCR recorder.
(r) Let the scanning continue to the end of the borehole. Monitor the progress of the operation on the TV monitor during this time. An unrolled and oriented image of the borehole wall will be recorded on the DAT and the VCR during this time.
(s) Once the end of the borehole is reached, turn off the DAT and VCR recorder and wind up the winch to retrieve the probe.
(t) Turn down the volume of light in the BSS probe gradually before turning off the power to the controller unit.

3.7 Electrical Hazards - Certain probes use 100 V DO. This current poses an electrical hazard in the event of a leak. When using such probes, the operator

should not directly touch the probe. The probe should be turned on once it has been inserted into the borehole.

4.0 Records Management and Acceptance Criteria

The data generated from the borehole scanning is stored on a Digital Audio Tape and a VHS tape. Unrolled images of the borehole wall is contained on both tapes.

Written records of borehole -names, location, depth, scan date and BSS operator should be maintained. Additionally, the DAT data should be backed up with a copy.

The digital data generated by following this procedure, calibration log and the scientific notebook describing processing and analysis of the data shall be submitted as a record package to the YMP-LBNL Record Processing Center.

5.0 Personnel Responsibilities

The Principal Investigator (PI) is responsible for assuring full compliance with this procedure. The PI shall require that all personnel assigned to work to this procedure shall have the necessary qualifications and training to adequately perform the procedure; and they shall have a working knowledge of the LBNL QA Program. When procedure-specific responsibilities are to be delegated to contributing investigators or other personnel, the details of these responsibilities are as stated in this procedure. Special qualifications and/or training unique to the conduct of this procedure are as follows: In the acquisition phase of the project, field supervisors and/or managers (or their designates) shall have a working knowledge of mechanical and electronic equipment. All ongoing investigations shall be Identified, at the location of the scientific investigation, to preclude inadvertent Interruption and to ensure compatibility of the investigations.

6.0 Acronyms and Definitions

BSS Borehole Scanner System
DAT Digital Audio Tape
VCR Videocassette Recorder
DDS Digital Data Storage

7.0 References

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8.0 Attachments None.

9.0 Revision History None.

10. Approvals

Preparer

Principal Investigator

Technical Reviewer

QA Reviewer

QA Manager

Project Manager